CHAPTER IV
WATER AND RELATED RESOURCES PROBLEMS AND NEEDS

Based on the overall authority of the SLWRI, and the without-project conditions described in Chapter III, following is a summary of major water resources problems and needs identified in the primary study area.

ANADROMOUS FISH SURVIVAL

The population of chinook salmon in the Sacramento River has significantly declined over the past 30 years. Numerous factors have contributed to the decline, including unstable water temperature; loss of historic spawning areas and suitable rearing habitat; water diversions from the Sacramento River; drought conditions; reduction in suitable spawning gravels; fluctuations in river flows; toxic acid mine drainage; unnatural rates of predation; and fish harvests.

One of the most significant environmental factors is unstable water temperature. Water temperatures that are too high, or in some cases too low, can be detrimental to the various life stages of salmon. Elevated water temperatures, primarily caused by reductions in river flow, can negatively impact spawning adults, egg maturation and viability, and preemergent fry, significantly diminishing the resulting ocean population and next generation of returning spawners. Stress caused by high water temperatures also may reduce the resistance of fish to parasites, disease, and pollutants. Conversely, water that is too cold is detrimental to the rapid growth of some juveniles. Following construction of Shasta Dam, water released in the spring was unusually cold and prevented the characteristic rapid growth of fall- and late-fall-run juvenile salmon. Reduced growth rates are detrimental to juvenile salmon because they must attain a length of about 70 millimeters to migrate downstream, and must out-migrate before temperatures in the lower Sacramento River and the Delta reach about 73 degrees.

Various Federal, State, and local projects are addressing each of the aforementioned contributing factors. Recovery actions range from changing the timing and magnitude of reservoir releases to changing the temperature of released water. In the 1993 NMFS BO for winter-run chinook salmon, SWRCB established certain operating parameters for Shasta Reservoir. This BO set surrogate or minimum flows in the river downstream from Keswick Dam primarily to affect water temperatures during key periods. Implementation of CVPIA (b)(2) fish actions is another important minimum flow assumption used in operational studies for surface water storage projects in the CALFED ROD.

In addition to flow requirements, structural changes at Shasta Dam have been made, such as completing the TCD in 1997, to better manage water temperature in the upper Sacramento River to benefit anadromous fish populations. The TCD can selectively draw water from different depths within the lake, including the deepest, to help maintain river temperatures beneficial to salmon. The TCD is effective in helping to reduce winter-run salmon mortality in some critically dry years, and for fall- and spring-run salmon in below-normal years.

Implementation of requirements contained in the Trinity River December 2000 ROD may conflict with water temperature improvements made by the TCD at Shasta Dam. One of the major elements of the Trinity ROD is reducing the average annual export of Trinity River water from 74 percent to 52 percent of the flow. This would reduce flow from the Trinity River basin into Keswick Reservoir, and then into the Sacramento River. Because water diverted from the Trinity River is generally cooler than flows released from Shasta Dam, implementing Trinity ROD flow reductions would offset some of the benefits derived from the TCD.

Findings in the 2000-2001 Biennial Report of the CDFG Commission on Sacramento River winter-run chinook salmon indicate that the total number of fish is increasing. This is likely due primarily to minimum release requirements at Shasta Dam and to the TCD. However, a residual need still exists for generally cooler water in the Sacramento River, especially in dry and critically dry years. This need for additional temperature management would increase should the Trinity River ROD be implemented.

WATER SUPPLY NEEDS

Demands for water in California exceed available supplies. As indicated previously in **Tables III-12** and **III-13**, the need for additional supplies also exists in the Central Valley and is expected to continue. As the population of the Central Valley continues to grow, along with the need for maintaining a healthy and vibrant industrial and agricultural economy, the demand for adequate and reliable water supplies will become more acute. **Table IV-1** is a summary comparison of existing and expected future water use versus available supplies in the Sacramento River and San Joaquin River basins and in the State under drought year conditions. As shown, it is estimated that the demand for water in the future will significantly exceed available supplies. Based on results of recent system modeling (CALSIM II), it is highly likely that expected shortages would be greater than those shown in the table.

It is believed that competition for available water supplies will intensify as water demands to support M&I and related urban growth increase relative to agricultural uses. **Table IV-1** also shows the expected trend in distribution of water supplies and water sources under drought year conditions (Bulletin 160-98) for 2020. In addition, projections are included based on 2040 population projections and 2020 water use rates. Data illustrate that although current and projected shortages are significant, just as important is understanding that much of the water required for new urban growth is projected to come from redirected agricultural uses.

Various potential options are identified in Bulletin 160-98 to help meet expected future water shortages in the Central Valley. They include constructing new dams and reservoirs on the Yuba and American Rivers and enlarging Friant Dam on the upper San Joaquin River, Pine Flat Dam on the Kings River, and Lake Kaweah on the Kaweah River. Bulletin 160-98 also identified construction of offstream storage at the Waldo Reservoir Site near the Yuba River. As part of the CALFED ROD, various projects were identified to help meet future water needs, including new surface water dams and reservoirs, groundwater storage, WUE, water transfers, conveyance improvements, and more. To date, feasibility scope studies are proceeding on only one project identified in Bulletin 160-98 and four of the of the new surface water storage projects identified in the CALFED ROD: SLWRI, NODOS Project, Upper San Joaquin River Storage Investigation, and Los Vaqueros Reservoir Enlargement Project.

TABLE IV-1
COMPARISON OF EXISTING AND FUTURE WATER USE VERSUS SUPPLIES UNDER DROUGHT YEAR CONDITIONS

Item	Sacramento & San Joaquin River Basins			California		
	2000	2020	2040	2000	2020	2040
Population (million)	5	7	10	35	46	59
Urban Use Rate (GPCPD)	309	288	288	247	242	242
Acres In Production (million)	4.1	4.1	4.1	9.5	9.2	9.1
Agricultural Use (AFPA)	3.9	3.8	3.8	3.6	3.5	3.5
Water Use (MAF)						
Urban	1.6	2.2	3.1	9.7	12.4	15.9
Agriculture	16.1	15.5	15.5	34.1	32.3	32.3
Environmental	6.1	6.1	6.1	21.2	21.3	21.3
Total	23.8	23.9	24.8	65.0	66.0	69.5
Supplies (MAF)						
Surface Water	16.1	16.0	16.0	43.5	43.3	43.3
Groundwater	6.1	6.2	6.2	15.8	16.0	16.0
Recycled & Desalted	0.0	0.0	0.0	0.3	0.4	0.4
Total	22.2	22.2	22.2	59.7	59.8	59.8
Shortage (MAF)	***1.7***	***1.7***	***2.6***	***5.4***	***6.2***	***9.8***
Key: AFPA - acre-feet per acre GPCPD – gallons per capita per day MAF – million acre-feet						

Source: Based primarily on information contained in the California Water Plan, Bulletin 160-98, with extended 2040 estimates using available population projects and 2020 water use rates.

Even with major efforts by multiple agencies to address the complex water resources issues in the State, aggressive water conservation, increased water recycling, and other water management measures, it is expected that demands will significantly exceed supplies. To avoid major impacts to the economy and the overall environment of the State, it is believed that developing additional water sources to increase the reliability of providing adequate supplies of water for M&I, agricultural, and environmental purposes is needed to meet future demands.

OTHER ENVIRONMENTAL OPPORTUNITIES

The health of the Sacramento River ecosystem, as elsewhere in the Central Valley, has been severely impacted in the last century by conflicts over the use of limited natural resources, particularly water resources. Humans have harnessed many of California's rivers and streams for beneficial uses such as hydropower, flood control, and water supply. One result has been a decline in habitat and native species populations, and a growing number of endangered and threatened species.

Construction of Shasta Dam has had both negative and positive effects on environmental resources in the region. Negative impacts of Shasta Dam include blocking historic fish migration into the upper watersheds of the Sacramento River, modifying seasonal flow patterns and the natural riverine processes that they support, and inundating fish and wildlife habitat. However, water resources within the reservoir also support a variety of environmental values and objectives throughout the Central Valley and Bay-Delta, playing a central role in environmental flow regulation and water quality. While construction of the dam displaced valuable riverine and upland habitat, it also created shoreline and shallow-water habitat for aquatic, terrestrial, and avian species. For example, Shasta Lake is home to the largest concentration of nesting bald eagles in California, with 18 pairs nesting within 0.5 miles of the shoreline in any given year.

Shasta Lake Area

Various activities have impacted natural resources upstream from Shasta Dam, within the lake, on adjacent lands, and in and near tributary streams. The greatest impact in the area has probably come from historic mining, ore processing practices, and resulting acid mine drainage, and fire suppression.

To guide management of STNF, USFS has prepared the STNFLRMP. Primary goals are to integrate a mix of management activities that allows use and protection of forest resources; meets the needs of guiding legislation; and addresses local, regional, and national issues. The STNFLRMP includes actions to implement management practices for increasing the amount of cover available for spawning and nursery habitat for warm water fish in Shasta Lake and its tributary streams. The STNFLRMP also is intended to guide implementation of the Aquatic Conservation Strategy of the Northwest Forest Plan for protection and management of riparian and aquatic habitats adjacent to Shasta Lake. CDFG has stocked Shasta Lake with chinook salmon and rainbow trout to support cold water fisheries.

Opportunities exist to further support ongoing programs of USFS. These opportunities include improving and restoring environmental conditions by developing self-sustaining natural habitat in the area of Shasta Lake and its tributaries to benefit fish and wildlife resources.

Downstream from Shasta Dam

Land and water resources development has caused major resource problems and challenges in the Sacramento River basin, including reductions in anadromous fish populations and riparian, wetland, floodplain, and shaded riverine habitat. In turn, this has resulted in reduced populations of many individual plant and animal species.

The quantity, quality, diversity, and connectivity of riparian, wetland, floodplain, and shaded riverine habitat along the Sacramento River has been severely limited from the confinement of the river system by levees, reclamation of adjacent lands for farming, bank protection, channel stabilization, and land development. Modification of seasonal flow patterns by dams and water diversions also has inhibited the natural channel-forming processes that drive riparian habitat succession. It is estimated that less than 5 percent of the historic acreage of riparian habitat within the Sacramento River basin remains today.

Reduced quality and quantity of habitat has resulted in reduced populations of many fish and wildlife species. The low populations and questionable sustainability of many species has led to an increase in listings under State and Federal ESAs in recent years. Introduction of nonnative species has also contributed to the decline in native animal and plant species. Lack of linear continuity of riparian habitat impacts the movement of wildlife species among habitat patches, adversely affecting dispersal, migration, emigration, and immigration. For many species, this has resulted in reduced wildlife numbers and population viability.

Ecosystem restoration along the Sacramento River has been the focus of several ongoing programs, including the CALFED Bay-Delta Program, SB 1086 Program, CVPIA, and the Central Valley Habitat Joint Venture. These and numerous local programs have been established to address ongoing conflicts over the use of limited resources within the Central Valley. Much effort has been directed in the upper Sacramento River region toward restoring or improving anadromous fisheries, which provide recreational and commercial values in addition to their environmental value. Despite these efforts, a significant need remains to restore and preserve ecosystem resources along the Sacramento River.

FLOOD PROBLEMS

Large and small communities and agricultural lands in the Central Valley are under the threat of flooding along the Sacramento River. The Corps is conducting a comprehensive, basin-wide study of flood management issues and options in the Sacramento River basin, and continues to develop the Sacramento River Bank Protection Project and assist in local flood control projects along the Sacramento River.

Flooding poses risks to human life, health, and safety. Development in flood-prone areas has exposed the public to the risk of flooding. While the existing flood management system has reduced the frequency of flooding, large storms can result in river flows that exceed the capacity of the system or cause failures in the system. The January 1997 flood revealed flood management system problems, including levee instability, insufficient conveyance capacity of many channels, and inefficiencies in flood management and warning programs and procedures. Threats to the public from flooding are caused by many factors, including overtopping or sudden failures of levees, which can cause deep and rapid flooding with little warning, threatening lives and public safety.

Physical impacts from flooding occur to residential, agricultural, commercial, industrial, institutional, and public property. Damages occur to buildings, contents, automobiles, and outside property, including agricultural crops, equipment, and landscaping. Physical damages include cleanup costs and costs to repair roads, bridges, sewers, power lines, and other infrastructure components. Nonphysical flood losses include income losses and cost of emergency services such as flood fighting and disaster relief.

Even though the Shasta Dam project has the potential to significantly control flood flows in the upper Sacramento River, influencing factors exist that can conflict with flood operation. Flood control operations at Shasta Dam, even with explicit rules provided in the flood control manual, are difficult to manage during a flood event. This is primarily due to the extreme inflow volumes to Shasta that can occur over long periods, numerous points of inflow along the river downstream from Shasta, and multiple points of operational interest downstream. The primary downstream control point along the Sacramento River that determines reservoir releases under real-time operation is Bend Bridge. However, other unofficial points of operation are considered, such as peak flows at Hamilton City or other rural communities that are at risk of flooding.

These factors, combined with the uncertainty of storm forecasting, can lead to staff exhaustion and, worse, loss of efficient control at Shasta Dam. Once this occurs, it could cause a cascading effect on flood problems downstream to the Delta. Accordingly, the need is recognized for improved flood protection along the Sacramento River.

HYDROPOWER NEEDS

Were California a nation, it would be the twelfth largest consumer of electricity, using roughly the same amount as South Korea and Italy. Among the 50 states, California is the second largest consumer of electricity. Although California has 12 percent of the nation's population, it only uses 7 percent of the electricity. This makes California the most-energy efficient state per capita in the nation. Even so, demands for electricity are growing at a rapid pace. As an example, over the next 10 years, California's peak demand for electricity is expected to increase 30 percent from about 50,000 MW to about 65,000 MW. There are, and will continue to be, increasing demands for new electrical energy supplies, including clean energy sources such as hydropower.